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NEET mock test - 1 (PHYSICS) 2022-23

Time : 75 Min	Phy : Full Portion Paper	Marks : 200

Hints and Solutions

01) Ans: **D)** 20 J
Sol: Initial velocity $u = 20\,m/s$; $m = 1kg$
Kinetic energy = maximum potential energy
Initial kinetic energy $= \frac{1}{2}\times 1\times 20^2 = 200\,J$
$Mgh(max) = 200\,J$
$\therefore h = 20\,m.$
The height travelled by the body, $h' = 18\,m$
$\therefore$ Loss of energy due to air friction
$= mgh - mgh'$
$\Rightarrow$ Energy lost $= 200\,J - 1\times 10\times 18\,J = 20\,J$

02) Ans: **C)** $\frac{g}{4}$
Sol: Let T be the tension in the branch of a tree when monkey is descending with acceleration a
Thus, $mg - T = ma$
Also, $T = 75\%$ of weight of monkey
$T = \left(\frac{75}{100}\right)mg = \frac{3}{4}mg$
$\therefore\ ma = mg - \left(\frac{3}{4}\right)mg = \frac{1}{4}mg$ or $a = \frac{g}{4}$

03) Ans: **D)** both (1) and (3) are correct.
Sol: Peaks on the graph represent characteristic X-ray spectrum. Every peak has a certain wavelength, which is dependent on the transition of electron inside the atom of the target. While λ_{min} depends upon the accelerating voltage as $\lambda_{min} \propto 1/V$.

04) Ans: **C)** $10^5\ N/m^2$
Sol: We know, $PV = \mu RT \Rightarrow P \propto \frac{T}{V}$. Thus from the relationship, if T and V both doubled then pressure remains same, means $P_2 = P_1$ = 1 atm
$= 1\times 10^5 N/m^2$

05) Ans: **A)** $V' < 2V$
Sol: To convert the galvanometer (of resistances) into voltmeter, a resistance R is connected in series.
$\therefore i_g = \frac{V_1}{R+G}$ and $i_g = \frac{V_2}{2R+G}$
$\Rightarrow \frac{V_1}{R+G} = \frac{V_2}{2R+G} \Rightarrow \frac{V_2}{V_1} = \frac{2R+G}{R+G} = \frac{2(R+G)-G}{(R+G)}$
$= 2 - \frac{G}{(R+G)} \Rightarrow V_2 = 2V_1 - \frac{V_1 G}{(R+G)} \Rightarrow V_2 < 2V_1$

06) Ans: **B)** 880 Hz
Sol: Here, fundamental frequency of closed pipe is
$n = \frac{v}{41} = 220\ Hz \Rightarrow v = 220\times 41$
If $\frac{1}{4}$ of the pipe is filled with water, then remaining length of air column is $\frac{31}{4}$.
Now, fundamental frequency = $\frac{v}{4\left(\frac{31}{4}\right)} = \frac{v}{31}$
and First overtone = $3\times$ fundamental frequency
$\Rightarrow = \frac{3v}{31} = \frac{v}{1} = \frac{220\times 41}{1} = 880$ Hz .

07) Ans: **D)** 1 rad/s
Sol: Here, angular speed, $\omega = \frac{v}{r} = \frac{100}{100} = 1\ rad/s$

08) Ans: **A)** 84
Sol: Here, $n_1\lambda_1 = n_2\lambda_2$
$\Rightarrow 62\times 5893 = n_2\times 4358 \Rightarrow n_2 = 84$

09) Ans: **C)** J -kg^{-1}
Sol: $V = \frac{W}{m}$ so, SI unit = $\frac{Joule}{kg}$

10) Ans: **D)** 4
Sol: Let two resistances are R_1 and R_2, then
$S = R_1 + R_2$ and $P = \frac{R_1R_2}{(R_1+R_2)}$
From given condition, S = n P i. e.
$(R_1+R_2) = n\left(\frac{R_1R_2}{R_1+R_2}\right) \Rightarrow (R_1+R_2)^2 = n\,R_1R_2$
$\Rightarrow (R_1-R_2)^2 + 4R_1R_2 = nR_1R_2$
$\therefore n = 4 + \frac{(R_1-R_2)^2}{R_1R_2}.$
Thus, minimum value of n is 4.

11) Ans: **A)** $6\,\mu F$
Sol: The given figure is same as a balanced Wheatstone's bridge, therefore $C_{eq} = 6\,\mu F$.

12) Ans: **D)** $\sqrt{\frac{10}{7}gh}$

Sol: Here, $v=\sqrt{\dfrac{2gh}{1+\dfrac{K^2}{R^2}}}=\sqrt{\dfrac{2gh}{1+\dfrac{2}{5}}}$ i.e. $v=\sqrt{\dfrac{10}{7}gh}$

13) Ans: **C)** wavelength of light used, inversely.

Sol: We know, Resolving power of microscope $\propto \dfrac{1}{\lambda}$.

14) Ans: **A)** $\dfrac{1}{7}(3\hat{i}+6\hat{j}-2k)$

Sol: Let, Resultant of vectors $\vec{A}$ and $\vec{B}$

$\vec{R}=\vec{A}+\vec{B}=4\hat{i}+3\hat{j}+6k-\hat{i}+3\hat{j}-8k$

$\vec{R}=3\hat{i}+6\hat{j}-2k$

$R=\dfrac{\vec{R}}{|\vec{R}|}=\dfrac{3\hat{i}+6\hat{j}-2k}{\sqrt{3^2+6^2+(-2)^2}}=\dfrac{3\hat{i}+6\hat{j}-2k}{7}$

$R=\dfrac{1}{7}(3\hat{i}+6\hat{j}-2k)$

15) Ans: **C)** I^2R

Sol: The impedance Z of a series LCR circuit is given by,

$Z=\sqrt{R^2+(X_L-X_C)^2}$

where,

$X_L=\omega L$ and $X_C=\dfrac{1}{\omega C}$, ω is angular frequency.

At resonance, $X_L=X_C$, hence $Z=R$.

$\therefore V_R=V$ (supply voltage)

$\therefore$ r.m.s. current, $I=\dfrac{V_R}{R}=\dfrac{V}{R}$

$\therefore$ Power loss $=I^2R=\dfrac{V^2}{R}$

16) Ans: **C)** $\dfrac{I}{2}$

Sol: Charge on capacitor plates at time t is, q=It.
Electric field between the plates at this instant is

$E=\dfrac{q}{A\varepsilon_0}=\dfrac{It}{A\varepsilon_0}$ ...(i)

Electric flux through the given area A/2

is $\phi_E=\left(\dfrac{A}{2}\right)E=\dfrac{It}{2\varepsilon_0}$ (Using (i)) ...(ii)

So, displacement current,

$I_d=\varepsilon_0\dfrac{d\phi_E}{dt}=\varepsilon_0\dfrac{d}{dt}\left(\dfrac{It}{2\varepsilon_0}\right)=\dfrac{I}{2}$ (Using (ii))

17) Ans: **B)** Volt x metre

Sol: We know, S. I. unit of electric flux is

$\dfrac{N\times m^2}{C}=\dfrac{J\times m}{C}$ = volt x m.

18) Ans: **A)** $x=y$

Sol: For every gas, $C_P-C_V=R$. $\Rightarrow x=y$

19) Ans: **B)** 1 : 20

Sol: Here, the volume remains constant, thus

$R^3=8000r^3 \quad \therefore R=20r$

$\therefore \dfrac{\text{Surface energy of one big drop}}{\text{Surface energy of 8000 small drops}}$

$\Rightarrow=\dfrac{4\pi R^2T}{8000\,4\pi r^2T}\Rightarrow=\dfrac{R^2}{8000r^2}=\dfrac{(20r)^2}{8000r^2}=\dfrac{1}{20}$

20) Ans: **A)** having a permanent electric dipole moment.

Sol: The polar molecules are the molecules have one end slightly positive and other end is slightly negatively charged separated by some distance. So, they have permanent electric dipole moment.

21) Ans: **D)** $L-P(V_2-V_1)$

Sol: We have, $\Delta Q=\Delta V+P\Delta V$

$\Rightarrow mL = \Delta U + P(V_2 - V_1)$

$\Rightarrow \Delta U = L - P(V_2 - V_1)$ ($\because$ m = 1)

22) Ans: **A)** 6 x 10^5 V/m

Sol: We know, $E=\dfrac{V}{d}\Rightarrow E=\dfrac{0.6}{10^{-6}}=6\times10^5$ V/m

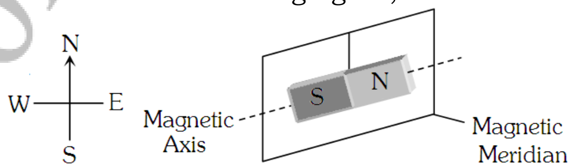
23) Ans: **C)** 0.004

Sol: We know,

$r\theta=L\phi\Rightarrow10^{-2}\times0.8=2\times\phi\Rightarrow\phi=0.004$

24) Ans: **B)** magnetic meridian.

Sol: From the following figure,



25) Ans: **A)** Diffraction

Sol: G.P. Thomson experimentally proved the existence of matter waves (de Broglie's hypothesis) by demonstrating that electron beams are diffracted when they are scattered by the regular atomic arrays of crystals.

26) Ans: **D)** decays $\dfrac{3}{4}$th.

Sol: Since $t_{1/2}$ is time in which substance decays half, therefore in $t_{3/4}$ time substance decays $\dfrac{3}{4}$th.

27) Ans: **B)** high resistance in series.

Sol: If ammeter is used in place of voltmeter means in parallel, it may damage due to large current in circuit. Hence, to control this large amount of current a high resistance must be connected in series.

28) Ans: **A)** 4g

Sol: Acceleration due to gravity is

$g=\dfrac{GM}{R^2}$. Therefore if radius shrinks to half of its present value, then g will becomes four times.

29) Ans: **C)** 24 N
Sol: Components of momentum parallel to the wall are in the same direction and components of momentum perpendicular to the wall are opposite to each other. Therefore change of momentum $= 2mv\sin\theta$

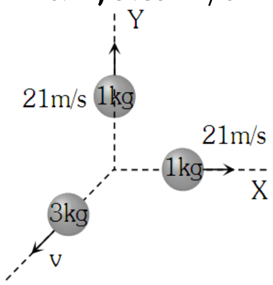
$F \times t =$ change in momentum $= 2mv\sin\theta$

$$\therefore \ F = \frac{2mv\sin\theta}{t}$$

$$= \frac{2\times 0.5\times 12\times \sin 30^{\circ}}{0.25} = 48\times\frac{1}{2} = 24\,N$$

30) Ans: **B)** 3 A
Sol: In the same phase, $\Delta\phi$ = 0, therefore resultant amplitude = $a_1 + a_2 = 2A + A = 3A$

31) Ans: **B)** 9.89 m/s



Sol:
Here, $P_x = m\times v_x = 1\times 21 = 21\ kg\ m/s$
and $P_y = m\times v_y = 1\times 21 = 21\ kg\ m/s$

$\therefore$ Resultant = $\sqrt{P_x^2 + P_y^2} = 21\sqrt{2}$ kg m/s

The momentum of heavier fragment should be numerically equal to resultant of $\vec{P}_x$ and $\vec{P}_y$.

$\therefore 3\times v = \sqrt{P_x^2 + P_y^2} = 21\sqrt{2}$ $\therefore$ $v = 7\sqrt{2}$ = 9.89 m/s

32) Ans: **C)** adiabatic change.
Sol: In adiabatic change Q = constant $\Rightarrow \Delta Q = 0$
Thus, $\Delta W = -\Delta U$ (As $\Delta Q = \Delta U + \Delta W$)

33) Ans: **B)** $\vec{v} = \vec{E}\times\vec{B}/B^2$

Sol: $\vec{v} = \vec{E}\times\vec{B}/B^2$

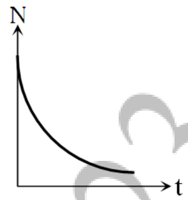
34) Ans: **A)** Pressure of water increases with depth.
Sol: A torque acts on the wall of the dam trying to make it topple. The bottom is made very broad in order that the dam will be stable.

35) Ans: **C)** 2.55 eV
Sol: Here, energy released

$$= 13.6\left[\frac{1}{(2)^2} - \frac{1}{(4)^2}\right] = 2.55\ eV$$

36) Ans: **C)** $B_0 l\,v\sin\delta$
Sol: When a conductor lying along the magnetic north-south, moves eastwards it will cut vertical component of B_0. Therefore the induced e.m.f.,
$e = vB_V\,l = v(B_0\sin\delta\,l) \Rightarrow e = B_0 l\,v\sin\delta$

37) Ans: **C)** Zero
Sol: Frictional resistance, $R = m(g - a)$,
for downward motion of lift.
If $a = g$, then $R = 0$ $\therefore$ $F = \mu R = 0$



38) Ans: **C)**

Sol: Using, $N = N_0 e^{-\lambda t}$ and $\frac{dN}{dt} = -\lambda N$.

It gives that N decreases exponentially with time.

39) Ans: **C)** Same for both
Sol: Here, from the problem given,

$$\frac{Q_1}{t} = \frac{KA(90-60)}{0.6} = 50\ KA$$

and $\frac{Q_2}{t} = \frac{KA(150-110)}{0.8} = 50\ KA$

40) Ans: **C)** 9 : 1

Sol: $\frac{W_1}{W_2} = 4 = \frac{I_1}{I_2} = \frac{a^2}{b^2}$ $\therefore \frac{a}{b} = 2$

$$\frac{I_{max}}{I_{min}} = \frac{(a+b)^2}{(a-b)^2} = \frac{\left(\frac{a}{b}+1\right)^2}{\left(\frac{a}{b}-1\right)^2} = \frac{(2+1)^2}{(2-1)^2} = \frac{9}{1}$$

41) Ans: **B)** 40π

Sol: We know that at centre, $v_{max} = a\omega = a.\frac{2\pi}{T}$

$$\Rightarrow v_{max} = \frac{0.2\times 2\pi}{0.01} = 40\pi$$

42) Ans: **B)** 5.320 cm
Sol: The measurement is correct upto third place of decimal. So, it must be 5.320 cm.

43) Ans: **A)** it is impossible
Sol: Efficiency is maximum in Carnot engine which is an ideal engine.

$$\eta = \frac{400-300}{400}\times 100\% = 25\%$$

$\therefore$ efficiency 26% is impossible for his heat engine.

44) Ans: **C)** $\frac{1}{2}\alpha\,t\times 86400$

Sol: We know that, loss in time per second is given by $\frac{\Delta T}{T} = \frac{1}{2}\alpha\Delta\theta = \frac{1}{2}\alpha\,(t-0)$

$\Rightarrow$ loss in time per day

$\therefore \Delta t = \left(\frac{1}{2}\alpha t\right) t = \frac{1}{2}\alpha t \times (24 \times 60 \times 60) = \frac{1}{2}\alpha t \times 86400$

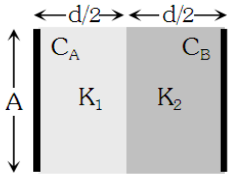
45) Ans: **C)** both will have the same speed when they hit the ground.

46) Ans: **A)** $\frac{2K_1K_2}{K_1 + K_2}$

Sol: In this case, $C_A = \frac{K_1\varepsilon_0 A}{d/2}, C_B = \frac{K_2\varepsilon_0 A}{d/2}$

$\therefore C_{eq} = \frac{C_1}{C_2} = \frac{2K_1K_2}{K_1 + K_2}$

$\Rightarrow C_{eq} = \frac{C_A C_B}{C_A + C_B} = \left(\frac{2K_1K_2}{K_1 + K_2}\right)\frac{\varepsilon_0 A}{d} \quad \left(\text{As } c = \frac{\varepsilon_0 A}{d}\right)$



47) Ans: **A)** holes and electrons.
Sol: Holes are majority charge carrier while electrons are minority charge carriers in P-type semiconductors.

48) Ans: **C)** 889 N
Sol: Force between earth and mass of 1 Kg is F = $\frac{GM_E \times 1}{R_E^2} = 10N$........(i) Where M_E is the mass of the earth and R_E is the radius of the earth respectively.
Force between earth and satellite is F' = $\frac{GM_E \times 200}{\left(\frac{3}{2}R_E\right)}$ ...(ii)

By dividing (ii) by (i) we get, $\frac{F'}{F} = \frac{800}{9}$

$\Rightarrow F' = \frac{800F}{9} = \frac{800}{9} \times 10N \quad (\because F = 10N \ \ldots\text{given})$

$= \frac{8000}{9} N = 889N$

49) Ans: **B)** $\vec{r} \cdot \vec{\tau} = 0$ and $\vec{F} \cdot \vec{\tau} = 0$

Sol: Torque is always perpendicular to $\vec{F}$ as well as $\vec{r}$. $\vec{r} \cdot \vec{\tau} = 0$ as well as $\vec{F} \cdot \vec{\tau} = 0$.

50) Ans: **A)** $\frac{1}{\sqrt{\mu_o \varepsilon_o}}$

Sol: We know,

$\mu_0 = 4\pi \times 10^{-7}, \varepsilon_0 = 8.85 \times 10^{-12} \frac{N\text{-}m^2}{C^2}$

$\therefore c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}} = 3 \times 10^8 \frac{\text{meter}}{s}$.